

## Lesson 15

### Laptops and Portable Devices

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## Portable Computer Types

- *portable computer* is any computer that contains all the functionality of a desktop computer system but is portable
1. Luggable
  2. laptop
  3. PDA.

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## 1- Luggable

- could weigh 50 pounds
- expensive.
- It's no wonder few people purchased them. Compaq, Kaypro, and Osborne made some of the first luggable computers.



## 2- Laptops

- They contain a built-in keyboard, pointing device, and LCD screen in a clamshell design.
- They are also called *notebook* computers because they resemble large notebooks.
- Most portable computers in use today are laptop computers.



### 3- palmtop computer personal digital assistant (PDA).

- These computers are designed to keep the information you need close by so you can access it whenever you need it.
- **There are two different approaches to the PDA.**
- Some, such as the Palm series of PDAs and HP iPAQ, are basically small digital notepads.
- Others, such as the RIM BlackBerry, are known as a handheld PC (HPC).  
These are basically shrunken laptops.  
HPCs run an operating system known as Windows Mobile

### Understanding Laptop Architecture

Laptops are similar to desktop computers in architecture in that they contain many parts that perform similar functions. However, the parts that make up a laptop are completely different from those in desktop computers.

1. difference is size
2. heat (less airflow)
3. laptop parts are designed to consume less power
4. most laptop components proprietary

### Laptops vs. Desktops

- Portability
- Cost
- Performance
- Expandability
- Quality of construction

### laptop parts

1. Laptop Case
2. Motherboards and Processors
3. Laptop Motherboards
4. Laptop Processors
5. Memory
6. Input Devices
7. Expansion Buses and Ports
8. Docking Stations
9. Power Systems



## Laptop Case

### A typical laptop case is made up of three main parts:

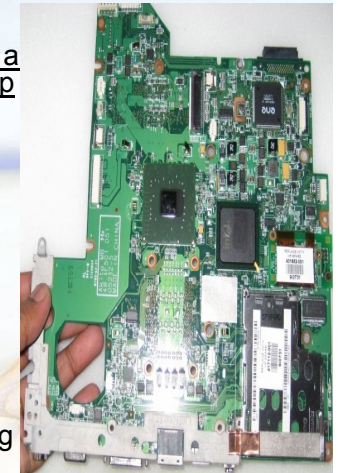
- The display usually an LCD display
- The case frame
- The case, plastic or lightweight metal, such as aluminum or titanium



## Motherboards and Processors

### Laptop Motherboards

- The primary differences between a laptop motherboard and a desktop motherboard are
  1. the lack of standards
  2. the much smaller form factor.
  3. almost all components must be integrated onto the motherboard, including onboard circuitry for the serial, parallel, USB, IEEE 1394, video, expansion, and network ports of the laptop
- if one part goes bad, you have to replace the entire board, which is more expensive than just replacing one expansion card.



## Laptop Processors

- **Laptop processors are engineered with the following features to reduce heat:**
  1. **Streamlined connection to the motherboard**

Laptop processors are generally either soldered directly to the motherboard or attached using the Micro-FCBGA (Flip Chip Ball Grid Array) standard, which uses balls instead of pins.  
In most cases, this means that the processor cannot be removed, meaning no processor upgrades are possible.
  2. **Lower voltages and clock speeds**

Two ways to **combat heat** are to slow the processor down (run it at a lower speed) or give it less juice (run it at a lower voltage).  
Again, less performance and less heat.
  3. **Active sleep and slowdown modes**

Most laptops will run in a lower power state when on battery power, in an effort to extend the life of the battery.  
This is known as **processor throttling**.  
The motherboard works closely with the operating system to determine if the processor really needs to run at full speed.  
If it doesn't, it's slowed down to save energy and to reduce heat.  
When more processing power is needed, the CPU is throttled back up.

- Notebooks don't use standard desktop computer memory chips, because they're too big
- But The same standards that apply to desktop memory compatibility apply to laptops. This means you can find DDR, DDR2, and DDR3 SODIMMs for laptops.
- To see what kind of memory your laptop uses, check either the manual or the manufacturer's website
- **there are now two common types of laptop memory package:**
  1. SODIMM
  2. MicroDIMM.
- Nevertheless, modern laptop manufacturers may still opt to go the proprietary route due to design considerations that favor a custom solution.

## Memory

## Small Outline DIMM (SODIMM)

- SODIMMs are available in a variety of configurations, including 32-bit (72-pin) and 64-bit (144-pin SDRAM, 200-pin DDR, 200-pin DDR2, and 204-pin DDR3) options.
- make sure the SODIMM you want to put into the laptop is compatible with the motherboard.
- DDR has all but topped out at 1GB per module, while DDR2 and DDR3 SODIMM modules can be purchased in 4GB capacities, which is on par with desktop DIMMs.





## MicroDIMM

- In fact, it is over 50 percent smaller than a SODIMM
- Another major difference is that the MicroDIMM does not have any notches on the bottom.
- Popular MicroDIMM form factors include 64-bit modules with 172 pins for DDR and 214 pins for DDR2.



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## Storage

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2.5 form factor



## Input Devices

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## Keyboards

- keys are smaller and closer together.
- use a multifunction key, you press and hold the Fn key and then tap the key labeled with the function you want, finally releasing the Fn key



## Mice and Pointing Devices



Trackball



Touchpad



Point Stick



Touchscreen

convertible and slate form factors. Arabic IT Certification Training Videos



Styluses and Digitizers

## Expansion Buses and Ports



## PCMCIA (Parallel PC Card) Expansion Bus

- stands for Personal Computer Memory Card International Association
- It was originally designed to provide a way of expanding the memory
- The PCMCIA bus has been renamed **PC Card** to make it easier to pronounce.
- PC Card adapters (converters) are available for desktop PCs.
- PC Cards are about the size of a **credit card** and provide us with **hot swappable devices** that can more easily be added to a system than their desktop counterparts
- PC Cards come in three types,
- The difference between these cards is in their designed function and **their thickness**.

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### Three major types of PC Cards (and slots) have been specified

	Length mm	Width mm	Thickness mm	Typical Usage
Type I	85.6	54.0	3.3	Memory (SRAM,Flash,etc)
Type II	"	"	5.0	Modems, LAN,sound cards, SCSI controllers,
Type III	"	"	10.5	Pc Card hard disks

All PC Cards share the **same 68-pin interface**, so any PC Card will work in any slot that's high enough to accept that card type.

Type II cards are by far the most common of PC Cards.

Therefore, most laptops will have two Type II slots, one above the other, to enable the computer to accept two Type I or II cards or one Type III card

These slots are all but extinct.

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### In addition to the card, the PC Card architecture includes two other components:

- **Socket Services software** is a BIOS-level interface to the PCMCIA bus slot. When loaded, it hides the details of the PC Card hardware from the computer. This software can detect when a card has been inserted and what type of card it is.
- **Card Services software** is the interface between the application and Socket Services. It tells the applications which interrupts and I/O ports the card is using. Applications that need to access the PC Card don't access the hardware directly; instead, they tell Card Services that they need access to a particular feature, and Card Services gets the appropriate feature from the PC Card.
- This dual-component architecture allows the PCMCIA architecture to be used in different types of computer systems (that is, not just Intel's). For example, Apple laptop computers based on Motorola processors currently use PC Cards for modems and LAN interface cards.

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## ExpressCard

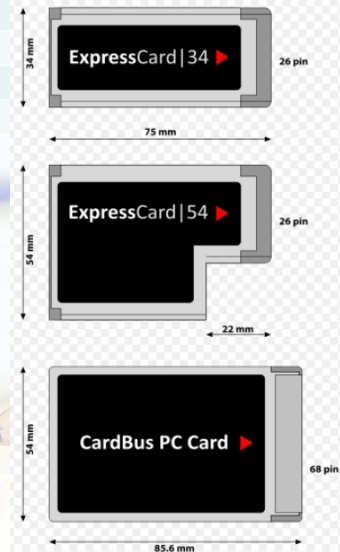
- ExpressCard, the high-performance **serial version** of the PC Card, has begun to replace PC Card slots on newer laptop PCs.
- ExpressCard and PC Cards are incompatible.
- ExpressCard comes in two widths: 54 mm and 34 mm.

Standard	Maximum Theoretical Throughput
PC Card using 16-bit bus	160 Mbps
CardBus PC Card using PCI bus	1056 Mbps
ExpressCard using USB 2.0 bus	480 Mbps
ExpressCard using PCIe bus	2.5 Gbps

accommodate more internal electronics.

The 34mm slot accepts only 34mm cards.  
The 54mm slot accepts both 34mm and 54mm cards.

A diagonal guide in the rear of the 54mm slot guides 34mm cards to the connector



## Mini PCI

- it's just a smaller version (about 25% the size of PCI cards) designed primarily for laptops.
- These cards reside internally in the laptop, with their connection ports generally lining up with the edge of the outside of the case.
- Mini PCI is functionally identical to the PCI version 2.2, meaning it's a 32-bit, 33MHz bus with a 3.3V-powered connection.
- Common Mini PCI devices include sound cards, modems, networking cards, and SCSI, ATA, and SATA controllers.
- Adapters are available that allow you to use a Mini PCI adapter in a standard PCI slot.



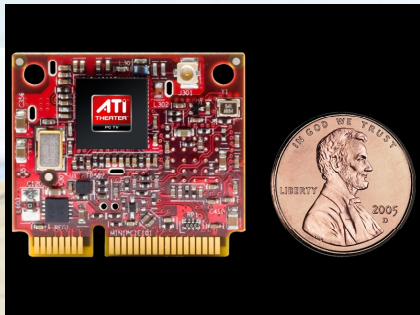


Board Type	PWB Size	Board Form Factor
IA	100-Pin Stacking	7.5 x 70 x 45mm
IB	100-Pin Stacking	5.5 x 70 x 45mm
IIA	100-Pin Stacking	7.5 x 70 x 45mm
IIB	100-Pin Stacking	17.44 x 78 x 45mm
IIIA	124-Pin Card Edge	2.4 x 59.6 x 50.95mm
IIIB	124-Pin Card Edge	2.4 x 59.6 x 44.6mm

### Mini PCI Form Factors

## Mini PCIe

- Mini PCI Express is a **replacement** for the Mini PCI standard used in many portable computers.
- Most laptops built after **2005** are based on PCI Express and can have several **Mini PCI Express Card slots**.
- The PCI Express Mini Card is half the size of the Mini PCI card.
- There is also a **52 pin** edge connector ( compared with Mini- PCI which has **124 pin connector** )
- cards are essentially ExpressCard devices without the external cover, measuring a few millimeters less in length and width as a result.
- In reality, however, they have a completely different, 52-pin edge connector.
- Nevertheless, like ExpressCard, Mini PCIe cards support USB 2.0 and PCIe x1 functionality.
- Additionally, Mini PCIe cards have the 1.5V and 3.3V power options in common with ExpressCard.



## USB & FireWire Ports

- Like desktops, laptops use USB ports for expansion. However, because of the lack of internal expansion in laptops, most peripherals for laptops are found either as PC Cards or USB expansion devices.



## Mouse/Keyboard Port

- Just in case you don't like using your laptop's built-in keyboard or pointing device, most laptops come with a combination *keyboard/mouse port* that allows you to connect either an external keyboard or an external mouse to the laptop.
- On laptops that **don't have USB ports**, this port is most often used for a standard **PS/2 mouse**.
- On those laptops **that do have USB ports**, this port is used for an **external keypad** or keyboard (because the USB port can accommodate an external mouse).

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## Communications Ports

- Several communication methods are available, and all new laptops have at least one of the following connections:
- analog dial-up modem,
- Infrared
- cellular
- Bluetooth
- 802.11
- Svido
- HDMI
- Ethernet.
- Each of these can also be added to laptops through USB or PC Card connection.

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## Docking Stations and Port Replicators

- we can use docking stations and port replicators to give our portable computers a **more desktop feel**.
- Docking stations allow us to **easily attach all manner** of peripheral devices to portable systems, including monitors, external hard disks, scanners, printers, digital cameras, and just about any other device you can imagine.
- All we need to do is attach peripheral devices to the docking station unit and leave them connected. When the portable system is attached to the docking station, all those connected devices will be accessible to the portable system just as if you were working with an ordinary desktop system.
- port replicator is similar to a docking station, but docking stations provide additional slots for adding expansion boards and storage devices.

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**Docking stations** provide additional ports as well as slots for inserting modules such as hard disk or a CDROM drive .

**Port Replicator** :Usually, a notebook computer will have limited I/O ports due to compact design. A port replicator provides additional I/O ports for adding additional devices such as a printer or a scanner.





Although portable PCs most often connect to port replicators via USB ports, some manufacturers have proprietary connections for proprietary port replicators. As long as such a portable PC has a USB port, you can use either the proprietary hardware or the more flexible USB devices.



### A docking port

These docking ports and docking stations are *proprietary*. That is, the port works only with docking stations designed by the laptop's manufacturer, and vice versa.

## Power Systems

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Portable computers can use either of two power sources:

1. batteries
2. adapted power from an AC or DC source.

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## Batteries

There are many different battery chemistries that come in various sizes and shapes.

1. Alkaline and Lithium Primary Batteries
2. Nickel Cadmium
3. Nickel-Metal Hydride
4. Lithium-Ion
5. Lithium-Polymer

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## 1-Alkaline and Lithium Primary Batteries

- An alkaline battery is usually found in palmtop computers and is the same battery type you find in calculators.
- Nonrechargeable alkaline batteries have an extremely high energy density.
- However, when used in power-hungry applications, such as digital cameras, alkaline batteries cannot keep up with the draw on their power and quickly lose the ability to provide the energy requested.

## 2-Nickel Cadmium (NiCad).

- *Is the* oldest technologies
- Its very heavy but inexpensive.
- susceptible to heat
- are rarely used in portable systems today, because of their shorter life and sensitivity to improper charging and discharging.
- (Memory effects) The life of the battery's charge can be shortened by as much as 40 percent if the battery is not fully discharged before recharging, or if it is overcharged
- NiCad batteries hold a charge well when not in use, losing 10 percent of their capacity in the first 24 hours and approximately 10 percent per month after that, and can be recharged 1,500 times or more.
- Environmentally poisonous

## 2-Nickel Metal-Hydride (NiMH)

- 30 % longer life than NiCads,
- same weight as NiCad batteries but are more expensive.
- still susceptible to heat,
- less sensitive to the memory effect caused by improper charging and discharging,
- Environmentally friendly because do not use the environmentally dangerous substances found in NiCads.
- NiMH batteries also require nearly twice as long to recharge as NiCads.
- While they are still used in many portable systems, NiMH batteries are now found mostly in computers at the lower end of the price range.

## 3-Lithium-Ion

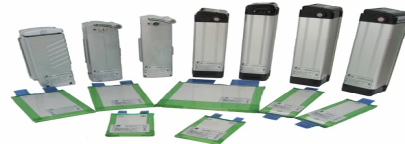
- last at least twice as long as comparable Ni-MH batteries on one charge.
- LiON batteries are lighter than both NiCd and NiMH notebook batteries.
- have no memory effect
- more expensive to manufacture
- Li-ion batteries are longer-lived than either NiCad or NiMH technologies, cannot be overcharged, and hold a charge well when not in use.



## 4-Lithium-Polymer

### lithium-ion polymer and polymer lithium-ion

- Lithium-polymer is a newer form of lithium-ion chemistry.
- can be formed into flat sheets as small as 1mm thick and of almost any size. Thus, a thin battery panel can be fitted into a portable computer behind the LCD panel.
- Lithium-ion polymer batteries provide an energy density that is four times better than a NiCad and a charge life that is 40 percent longer than a Li-ion battery, at one-fifth the weight.
- have no memory effect
- expensive to manufacture
- Once they are manufactured in sufficient quantities, lithium-ion polymer batteries could replace the bulky battery packs used today in portable systems.



## Maximizing battery performance

- **Be sure to fully charge and discharge a new battery or a battery that has not been in use for a while.**
- **Regularly charge and discharge batteries completely every two to three weeks to keep them healthy.**  
All battery types function best if they are completely discharged before recharging. Even lithium ion batteries perform better and last longer if they are discharged before being recharged.
- **Keep batteries clean. This helps maintain a good connection between the battery and the portable device.**
- **Don't leave batteries dormant for long periods of time.**
- **Store batteries well. Be sure to store batteries in a cool, dry, clean place, refrigerator away from dangerous elements such as heat and other metallic objects.**

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## Power Adapters

- converts AC-power input to DC output. The adapter is either integrated into the notebook or is more often a separate "brick" with two cords, one that plugs into the back of the laptop and another that plugs into a wall outlet.
- Another power accessory that is often used is a *DC adapter*, which allows a user to plug the laptop into the power source (usually a cigarette lighter) inside a car or on an airplane.



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- **Use caution when selecting a replacement AC adapter for your laptop.**

1. You should choose one rated for the same or higher wattage than the original.
2. plug that interfaces with the laptop.
3. power grid of the surrounding region.

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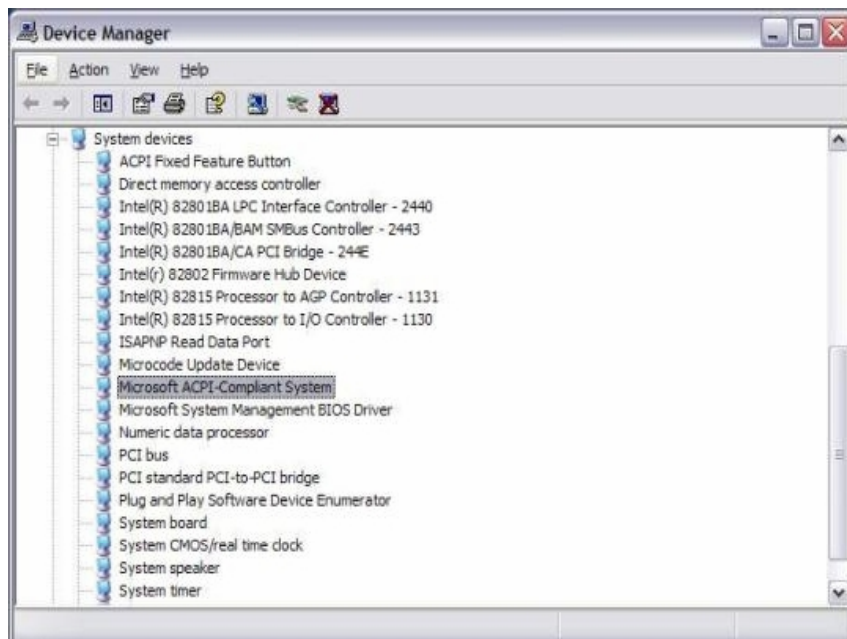
## Laptop Power Management

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## ACPI

- One of the features of most modern BIOS systems is support for *Advanced Configuration and Power Interface (ACPI)*.
- standard that has been developed by Intel, Microsoft, and Toshiba
- *First released as an open standard in 1996 (windows 98), ACPI defines common interfaces for hardware recognition and configuration and, more important, power management.*
- **ACPI has two important power management features.**
- First, it gives control of power management to the operating system.
- Second ACPI allows power management features that were once only found on laptops to be available on desktops as well.
- For ACPI to work, the motherboard, CPU, and operating system all need to support the standard.

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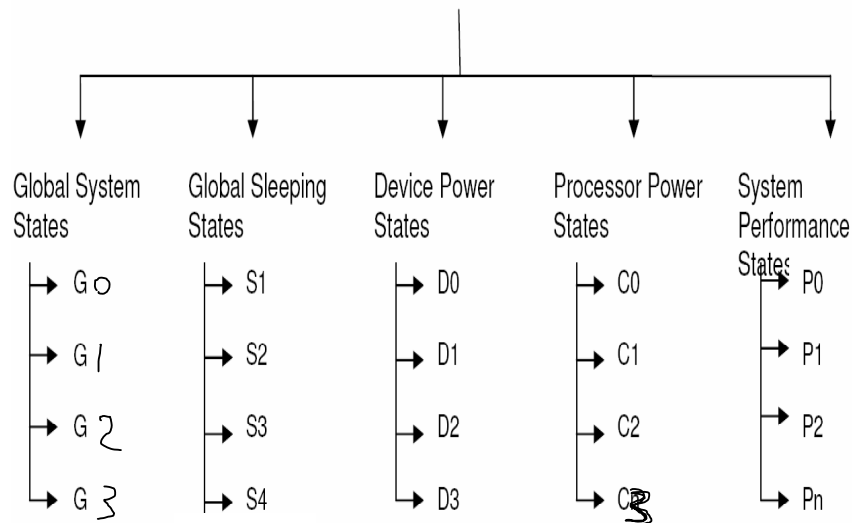


- To manage power in a better way, ACPI defines many power states for an entire system, device, processor, etc.
- It then interacts with the User Interface and hardware to decide dynamically which power management policy to be used.
- Let us take a bird's eye view on the same

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## ACPI Power States



## Global System States

Global System states are visible to the user.

- G0** is completely working state. The system is fully functioning with absolutely no power conservation. The User interface is completely active.
- G1** is a sleeping state with the best resume latency. Some rudimentary amount of power is conserved. Here work can be restarted without booting the OS. The system seems to be off from user's perspective. However the applications and backend process are running and doing their job well. The system wakes up after a pre-configured event occurs, which can be from an application interface or a Hardware directly.
- G2** This is simply a power down initiated by the operating system. You execute a soft off by clicking the Turn Off Computer or Shutdown buttons in Windows. It's a computer state where only minimal power is used. This state requires large latency to return back to normalcy.
- G3** G3 is mechanical off. It is equivalent to unplugging your system abruptly or This is what happens when the power button is pressed for the required five seconds, and it is a complete power down. Full rebooting the entire system.

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## System Sleeping States

Sleeping states are only applicable in Global G1 state.

- S1** S1 is the most power-hungry sleep mode (low latency wake state). The CPU stops executing instructions and the processor cache is flushed, but power is still provided to the CPU and memory. All devices not being used are powered down. screensaver appears
- S2** uses less power than S1 because The CPU is powered off. S2 is not typically utilized. reached by logging out
- S3** also called *Standby in Windows*. (Suspend to RAM) when put into S3, the computer maintains power only to the RAM only. information is stored in RAM, when the user brings the computer back from S3, the user can start right where he or she left off. However, if you lose power while in S3, all of the information being held in RAM is gone
- S4** is called *Hibernation in Windows*. (Suspend to Disk.) the information in RAM is written to the hard disk, and the RAM is powered off as well. This means that a user can take the computer from S4 back to G0 and still work from where he or she left off, but it will take longer

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## Processor States

- C0** is the highest power consuming state of a processor. It is the only state in which a processor is executing instructions. is the operational state
- C1** is a powered-down state, (often known as *Halt*) C1 is a lower power state in which processor stops executing instructions but the processor can return to action nearly instantaneously. It might seem amusing to know that your processor, may stop executing instruction even when the system is fully active. When reading a PDF and no other application running, what should be the expectation from a processor? Once the required application is loaded in RAM and active, the processor can definitely remain idle.
- C2** sometimes called Stop-Clock, uses less power than C1. is a state where the processor maintains all software-visible state, but may take longer to wake up, this processor state is optionally supported by the system. i.e. when display is visible but no operation is done by user's intervention. This is of course before the screensaver starts
- C3** Sleep mode. In this state, the processor cache is flushed, and it will take a few seconds for the processor to be available.

## Device states

D0	D0 Fully On is the full operating state.
D1	are intermediate power-states whose definition varies by device. Neither uses full power each device specifically defines its own D1 and D2 states. these power states are applicable only when the Global State G0.
D2	
D3	the device is completely powered down note that all the devices need not be active all the time. CD ROM Drive is always in D3 state. As soon as we click on Eject or press the button on its slider, it sends a wake signal to the OS which brings the device back to D0 and then the slide opens.

## Performance States

- Think of performance states as sublevels to processor and device states.
- Processors or devices in normal running modes (C0 or D0 state) can be in a lower power-level using a performance state.
- Performance states are designated P0-P<sub>n</sub>, where *n* can be 1–16. As with all other states, bigger numbers indicate greater power savings, as well as more latency to
- become fully operational . Some manufacturers have tried to brand their performance states.
- Intel calls its implementation SpeedStep, and AMD labels its version as Cool'n'Quiet.

